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| Research Article / Araştırma Makalesi |

A Case Study on Teachers' Knowledge and Classroom Practices about Mathematics Learning Difficulty

Öğretmenlerin Matematik Öğrenme Güçlüğüne İlişkin Bilgileri ve Sınıf İçi Uygulamaları: Durum Çalışması

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Keywords

1. Mathematics learning difficulty
2. Teachers' views
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Anahtar Kelimeler

1. Matematik öğrenme güçlüğü
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Abstract

Purpose: This study aimed to determine teachers' knowledge of mathematics learning difficulty and their classroom practices.

Design/Methodology/Approach: Data were collected through a semi-structured interview form from twenty teachers selected by criterion sampling method. The content analysis technique was employed for data analysis. As a result of the analysis, two themes were identified: a) teachers' knowledge and b) teachers' classroom practices.

Findings: As a result of the research, teachers mostly defined mathematics learning difficulties as deficiencies in mathematical skills, numbers, problem solving, four operations, calculation, and difficulty in learning mathematical concepts. In classroom practices, teachers generally used lecture, learning by doing, drama, demonstration, games, peer teaching, one-to-one teaching and question-answer methods.

Highlights: The results of the study revealed teachers' knowledge and practice limitations regarding mathematics learning difficulties.

Öz

Çalışmanın amacı: Bu araştırmanın amacı öğretmenlerin matematik öğrenme güçlüğüne dair bilgilerinin ve sınıf içi uygulamalarının belirlenmesidir.

Materyal ve Yöntem: Ölçüt örnekleme yöntemi ile belirlenen yirmi öğretmenden yarı yapılandırılmış görüşme formu aracılığıyla veriler toplanmıştır. Toplanan verilerin analizinde içerik analizi tekniği kullanılmıştır. Analiz sonucunda iki tema ortaya çıkmıştır: a) öğretmenlerin bilgileri, b) öğretmenlerin sınıf içi uygulamaları.

Bulgular: Araştırma sonucunda öğretmenler çoğunlukla matematik öğrenme güçlüğünü matematik becerilerindeki eksiklikler, sayılar, problem çözme, dört işlem, hesaplama, matematiksel kavramları öğrenme güçlüğü olarak tanımlamışlardır. Sınıf içi uygulamalarda ise öğretmenlerin genellikle düz anlatım, yaparak yaşayarak öğrenme, drama, gösterip yaptırma, oyun, akran öğretimi, birebir öğretim ve soru-cevap yöntemini kullandıkları görülmüştür.

Önemli Vurgular: Araştırmadan elde edilen sonuçlar öğretmenlerin matematik öğrenme güçlüğüne dair bilgi ve uygulama sınırlılığını ortaya koymuştur.

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INTRODUCTION

Mathematics learning difficulty (MLD) is defined as students' inability to understand mathematical processes and difficulty in performing tasks involving numbers or mathematical symbols (Khin Eng & Sai Hoe, 2021). It is characterized by difficulties in various mathematical skills that cannot be explained by low intelligence, neurological disorders, or inadequate education (Munez et al., 2023; Sudha & Shalini, 2014). Since it is a broad term that covers different types of difficulties that occur in the process of learning mathematics, some researchers classify these difficulties under three categories: a) difficulty using mathematical concepts, which relates the failure to recall technical terms, the inability to express the meaning of terms related to specific concepts, and the difficulty in remembering one or more conditions related to an object, b) difficulty using mathematical principles including mathematical calculations or operations, abstract patterns, and difficulties in explaining the meaning of principles, and c) difficulty solving verbal problems, which involves the knowledge and skills of using concepts and principles (Pramesti & Prasetya, 2021).

The cause of MLD can be recognized when students start to learn mathematics formally in the first grade (Salihu & Räsänen, 2018). The American Psychiatric Association (2013) reported that between 5% and 15% of school children have learning disabilities that prevent them from achieving numerical proficiency. These rates indicate that in a class of 30 students, at least one student shows signs of MLD (Hannell, 2013). Therefore, teachers' awareness of what kind of difficulties students may have in the process of learning mathematics guides how mathematics instruction should be designed (Wijaya et al., 2019). In other words, it is essential for teachers to be knowledgeable about MLD not only to correctly identify students with MLD but also to implement effective practices in the learning environment.

In learning environments, students with MLD, one of the groups of students with special educational needs who cannot fully adapt to standard education programs, need special teaching methods and support services due to the various difficulties they experience in the learning process. The most important tool for meeting the educational needs of students with MLD is Individualized Educational Plan (IEP). IEP is a written document that covers the developmental performance of individuals with special needs, their educational goals and how these goals will be realized and evaluated; it is developed in cooperation with families, teachers and other relevant experts and documents the necessary services and adaptations for the needs of individuals with special needs (Berkant & Atılgan, 2017). The IEP provides an important framework for determining the educational needs of students, setting goals, monitoring progress and adapting the educational program when necessary (Akhanlı et al., 2024). At the same time, it also contains the environment in which the student will receive education, the materials to be used for the student, methods and techniques. Overton (2014) states that while the IEP includes the current academic achievement and functional performance of the student with special needs, this performance includes the effect of the existing inadequacy on the student's participation and achievement in the general education classroom. In other words, the IEP reveals the current performance of students and explains how the inadequacies of students affect their progress in the general education curriculum. Thus, it is possible to determine where the student is in the curriculum and in which areas he/she needs to develop.

Teachers' experiences and perspectives influence their planning and integration of mathematics practices into the learning environment (Cross Francis et al., 2015). Research indicates a relationship between teachers' beliefs and their classroom practices (Beswick, 2017; Sherer et al., 2016). The evidence suggests that structured and controlled classroom practices are necessary to prevent students with MLD from underperforming and to achieve effective learning outcomes. Additionally, the use of intriguing materials can help to capture the attention of these students in mathematics learning environments. For instance, materials that engage multiple senses, such as visual aids like beads or cereals, colored cubes, numbered markers, musical connections, pizza slices, and blocks, are recommended (Kelly, 2020). The use of concrete objects in the teaching process helps students to understand mathematical concepts better. In a meta-analysis, Ise and Schulte-Körne (2013) emphasized that successful outcomes in teaching mathematics to students with MLD can be achieved through individualized instruction, the creation of a structured and hierarchical curriculum, tailoring the lesson to the student, and the use of lots of repetition. However, research indicates that even experienced teachers have limited knowledge about strategies to intervene in MLD (Sousa et al., 2017; Tennant & Tennant, 2010; Wijaya et al., 2019) and lack sufficient awareness about MLD (Chinn & Ashcroft, 2006; Fu & Chin, 2017; Hacısalihoğlu Karadeniz, 2013).

Students with MLD in learning environments can be considered a significant educational concern. Therefore, it is crucial to identify MLD early and intervene appropriately in advance. Teachers should be knowledgeable about MLD and instructional practices to effectively remediate difficulties and errors. In a learning environment with students of different abilities and learning styles, teachers must be aware of their students' needs and differences. The comprehensive structure of MLD, including various mathematics learning problems, can create knowledge and practice gaps. Most teachers have insufficient knowledge about the characteristics, symptoms, and intervention strategies of MLD (Soo May & Sai Hoe, 2022). Thus, describing teachers' knowledge of MLD and its applications for these students in learning settings is necessary. It is also essential to describe how they design the classroom environment and their preferred methods, techniques, strategies, and materials.

A review of the literature reveals a paucity of research on MLD and a recent increase in research on the topic. A comparison of MLD to dyslexia, another subset of learning difficulties, reveals a significant disparity in the amount of research conducted on each, particularly a 14:1 ratio of studies on dyslexia to studies on MLD (Price & Ansari, 2013). There appears to be a need to research MLD to fill these gaps in the literature. Studies conducted with teachers working with students with MLD in Turkey aimed

to examine the views of teachers and families on the difficulties experienced by students with MLD and the reasons (Temur et al., 2018), the observations and experiences of classroom teachers on MLD (Kaçar, 2018), and the harmony of classroom teachers' opinions on MLD and teaching practices (Avcı, 2020). Some studies have been directed at investigating middle school teachers' perceptions of MLD (Alkan Nurkan & Yazıcı, 2020; Hacısalihoğlu Karadeniz, 2013). Overall, it was necessary to conduct this study due to the limited number of studies in the literature that addressed knowledge and teaching practices related to MLD. Furthermore, this research aims to contribute to the literature by describing the knowledge and practices of primary school teachers, revealing their knowledge about how teachers define MLD difficulty, the causes of MLD and the effects of MLD on students, evaluating the work teachers do before and during the teaching process, whether they make the environmental organization of the classroom, how they evaluate student achievement, and evaluating how they evaluate student achievement within the framework of classroom practices, and addressing the difficulties experienced in classroom practices in detail. The study will shed light on the knowledge of the teachers about MLD and their practices in the classroom.

METHOD/MATERIALS

Research Design

This research involves a case study that seeks to uncover teachers' knowledge and classroom practices regarding MLD. A case study is a method that involves an in-depth examination of one or more events, environments, programs, social groups, or other interconnected systems (Yıldırım & Şimşek, 2016). Yin (1984) identified four types of case studies: single holistic case designs, single embedded case designs, multiple holistic case designs, and multiple embedded case designs. In single holistic case designs, the unit of analysis can be either a single individual, school, or institution. In a single embedded case design, multiple substrates exist within a single case. On the other hand, the multiple holistic case design is preferred when there is more than one unit of analysis. Similarly, in the multiple embedded case design, there are multiple situations, and each situation is divided into sub-units (Yıldırım & Şimşek, 2016). Teachers' knowledge and classroom practices regarding MLD were considered a single case in the research. Thus, the study is designed as a holistic single case study.

Study Group

The study group for the research was determined using criterion sampling, one of the purposive sampling methods. This method of sampling involves the study of a situation that meets a set of predetermined criteria (Yıldırım & Şimşek, 2016). In the present study, the criteria for working with one or more students with MLD currently in primary school and volunteering to participate in the research. Twenty teachers who fulfilled the criteria were included. To comply with ethical rules, the names of the teachers were kept confidential, and they were identified as T1, T2, and so on. Demographic information about the teachers is given in Table 1.

Table 1. Demographic information about the teachers

		f	%
Gender	Female	6	30
	Male	14	70
Educational level	License	14	70
	Master's degree	6	30
Year of service	6-10 years	1	5
	11-15 years	3	15
	16 years and above	16	80
Branch of teachers	General education teachers	20	100
The classrooms where teachers work	3	10	50
	4	10	50
The socioeconomic status of the school where they work	Middle	13	65
	High	7	35

According to Table 1, 70% of the participants were male, while the remaining 30% were female teachers. Almost a third (30%) of the teachers had a master's degree. 16 of the teachers had 16 or more years of service, while 4 teachers had 1-3 years of service. All teachers (100%) are general education teachers, and two-thirds (65%) work in middle socio-economic status schools. Half of the teachers (%50) work in the third grade and the other half (%50) in the fourth grade.

Data Collection Tools

The researchers developed a semi-structured interview form to collect the research data. The form consisted of two parts. In the first part, the demographic information of the teachers (gender, level of education, and years of service) was obtained; in the second part, open-ended questions were posed to ascertain their knowledge of MLD and their views on classroom practices. The questions in the interview form were presented to the teachers in the same order. Teachers were given questions such as how they define MLD, whether they adjust for students in classroom practices, and if so, what these adjustments may be, and what

kind of practices they use to support mathematical skills. For example: Do you have any information about MLD? How do you define MLD?

Data Collection Process

The interviews were conducted in an available room within the schools where the teachers worked during the appropriate time periods. The interviews were recorded using a voice recorder with the teachers' permission. The interviews typically lasted 45-70 minutes. The interviews were conducted by the second author.

Data Analysis

After the interviews, the teachers' views on the topic were analyzed using the content analysis technique. Content analysis is defined as a systematic and repeatable technique in which some words of a text are combined with smaller content categories through coding based on specific rules (Büyüköztürk et al., 2015). In this study, teachers' responses to each question were first transcribed. Then, words or groups of words were identified following the purpose of the research, and codes were formed; themes were formed by bringing together codes related to each other.

Reliability

To ensure the research's credibility, transferability, reliability, and confirmability, the following measures are taken: Participant verification is necessary to ensure credibility (Maxwell, 2004). To avoid misunderstandings and misinterpretations, the codes, categories, and themes the researcher had created were sent to the teachers for their opinions on whether their comments were correct. Transferability is ensured by providing detailed information about the research (Creswell, 2014). In this regard, how the study group was determined, and the characteristics of the participants were described. Reliability is ensured by more than one researcher coding the data sets and ensuring the consistency between the codes (Yıldırım & Şimşek, 2016). First author listened to the audio recording of all the interviews in order to assess that the transcripts of the interviews were correct. With the decision that the interviews were complete and correct, the research data were analyzed. The teachers' responses to each interview question were examined separately by two researchers. Within the scope of the themes and sub-themes created in the light of the obtained data, the topics with “consensus” and “disagreement” were discussed. If the researchers marked the same category in the relevant question or did not mark any categories related to the question, this was considered a consensus; if the researchers marked a different category from each other, it was considered a disagreement. In this case, the analysis made by the first author is referenced. The reliability calculation of the research was calculated using the formula reliability = consensus/ (consensus + disagreement). As a result of the comparison of the coding conducted by the researchers, the percentage of agreement was found to be 0.90. Confirmability was ensured by including direct quotations in the findings section. The formulation of interview questions, data collection, analysis, interpretation of findings, and results were presented. Approval for the ethical compliance of the research was obtained from the university.

FINDINGS

The findings collected from the semi-structured interviews with the teachers are categorized under two main themes. Figure 1 shows the themes and sub-themes.

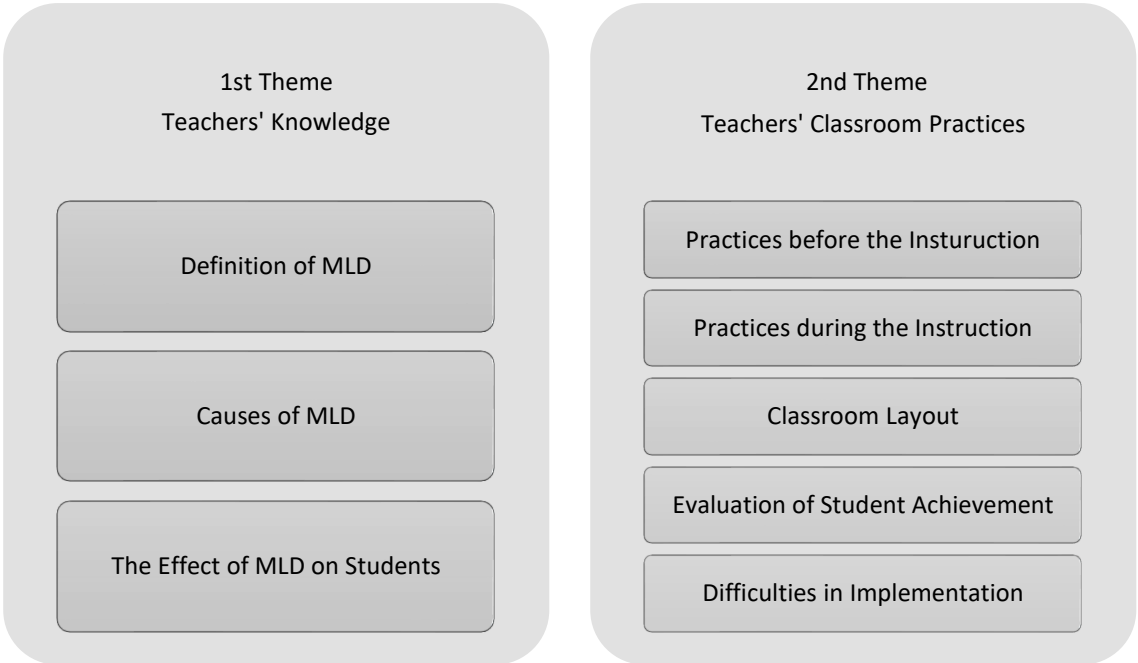

Figure 1. Themes and sub-themes

Theme 1: Teachers' Knowledge

In this section, the theme of teachers' knowledge is elaborated with the sub-themes of the definition of MLD, the causes of MLD, and the effect of MLD on students.

Definition of MLD

All the teachers stated that they knew the concept of MLD. When asked to define MLD, most of the teachers defined MLD by emphasizing the deficiency of one or more of the sub-skills in mathematics. According to the responses received from the teachers, the deficiencies in mathematics skills were listed as numbers, problem-solving, four operations, calculation, and learning mathematical concepts. For example, T18 stated, *"These are the difficulties and inadequacies that arise in situations such as comprehending mathematical operations, calculating, recognizing, and using numerical symbols. Individuals struggle to write numbers, perform simple operations, and solve problems."* In his definition, T5 expressed, *"It is used for those who have difficulty in the concepts related to the mathematics course and who cannot be successful in fulfilling the gains. It is a concept used especially for those who fail to solve problems requiring two or more operations.''* Among these sub-skills, teachers highlighted the most deficiencies in operations with numbers. The following expressions were used to show that MLD has difficulty with numbers: T7 *''Difficulty finding the number corresponding to the object. Inability to recognize numbers.''* According to T4, *"It is defined as the inadequacy of the student's ability to perform operations and not understanding simple operations."*

Strikingly, teachers make a distinction between MLD and intellectual disability. Only four teachers emphasized that MLD is related to difficulty learning mathematics despite having average intelligence. T13 said, *"It has difficulty grasping numbers and symbols despite no mental problem. In addition and subtraction, even if the questions are simple, solving them can take significant time."* Additionally, it is often the case that students forget what they have learned. T15 expressed, *"I can define it as a special learning disorder causing difficulty in performing mathematical operations and establishing a relationship between operations although there is no mental problem.''*

In particular, two teachers defined MLD as a learning situation that requires repetition. For instance, T6 maintained, *"A student tries to learn subjects later and with more repetition among their peers."* T9 also added *''The situation of learning numbers and operations with numbers for a longer time and with more repetitions than normal.''* However, in one of the teachers' definitions, mathematics and reading skills were associated with each other, and it was stated that MLD emerged because of deficiencies in reading skills. T8 expressed, *"MLD can be defined as the inability to visualize the question in the mind or the inability to understand what is read."*

Causes of MLD

Teachers formed several opinions about the causes of MLD. Among these views, teachers stated that the most common cause of MLD was genetic and hereditary (f=11). It was noteworthy that three teachers stressing the absence of intellectual disability in defining MLD emphasized genetic factors. T15 said, *"Hereditary factors may be effective in forming this condition."* T18 explained, *''Hereditary characteristics from the family can cause learning difficulties.''*

Results also revealed that the teachers' knowledge was superficial and general. Notably, the teachers mentioned the reasons for the emergence of other disability groups and frequently mentioned the factors that may cause low achievement while listing the causes of MLD. For example, students' negative attitudes (f=7), teaching difficulties (f=7), intelligence/intellectual disability (f=6), and environment (f=5) were the most underlined concepts. T14 stated, *''Besides mental ability and inability, situations such as learned helplessness and prejudice can be effective. It may also be the inadequacy of materials."* Additionally, T2 said, *''Not using intelligence, when necessary, not making mathematics teaching enjoyable and easy, inexperience of the teacher and leader.''* The teachers' explanation of the causes of MLD is shown in Figure 2.

Figure 2. Word cloud explaining the causes of MLD

However, teachers' opinions on the causes of MLD displayed the limitations of their knowledge. Curriculum intensity (f=3), attention deficit (f=3), family indifference (f=3), reading difficulties (f=2), nutrition (f=1), pre-natal and post-natal reasons (f=1), exposure to technology (f=1), socio-economic status of the family (f=1), and hyperactivity (f=1) were among the findings. For example, T7 expressed, *''Negative events before and after birth - falls, accidents, etc. –might affect."* T11: *''S/he may spend too much time with stimuli, such as tablets, computers, phones, etc. Family indifference may also occur*."

The Effects of MLD on Students

All teachers stated that MLD negatively impacts students' education and daily lives. Teachers explained how failing national and international mathematics class exams affects educational life. All the teachers of this opinion underscored the negative manifestation of low mathematics achievement in the classroom on friendships. In this regard, T4 stated, *"It may negatively affect students' educational life in the classroom. They may be exposed to the negative attitudes of their classmates."* Similarly, T10 expressed, *''Mathematics has a major significance in an exam-oriented system. Mathematics questions are pivotal in national and international exams.''*

Another notable finding is the teachers' consideration of the psychological effects of students suffering from MLD. Teachers point out that students' failure in mathematics might initiate ridicule and loss of self-confidence. Students with MLD may be subjected to harsh reprimands from teachers, family, and peers and at an increased risk of social isolation. T15 stated, *"Students with MLD can be ridiculed in their educational life. If the teacher is unaware of this issue, negative words can make this distinctive situation of the child more difficult. Likewise, the actions of parents unconscious of the situation may negatively affect the development of the child.''* Besides, T16 mentioned, *"It can cause serious psychological problems in children's educational lives. There is a feeling of failure. There is a loss of self-confidence. Since there will inevitably be peer pressure, psychological problems may appear."* One of the teachers implied that the effect on student psychology can only be visible during the school period and will disappear in adulthood. T9 explained, *''The individual with MLD may become disinterested in mathematics over time and gravitate towards verbal fields. However, as they mature, they may become more comfortable with math and use it as needed.''*

Another point worth mentioning is the scarcity of teachers (f=2) stating the daily difficulties that students with MLD may experience. It was claimed that mathematics is a crucial skill for daily life, such as telling time, shopping, and figuring out money. For example, T8 said, *"They may have problems while shopping in the canteen and grocery store."* T11 expressed, *''It negatively affects the daily life skills of especially primary school students. They cannot tell the time; they have difficulty in recognizing it. They cannot calculate change, etc.''*

Another crucial finding is that teachers have varying views on the impact of MLD on professional life. While some teachers believe that mathematics is essential for every profession, others argue that students may face limitations in their career choices due to MLD. Inferior performance in mathematics can negatively impact career decisions. T17 stated, *"Fields such as medicine, engineering, aerospace, and genetics are commonly considered qualified professions and require a strong background in mathematics. Therefore, students with MLD may face difficulties pursuing a career in these fields."* Additionally, T5 stated, *"Mathematics is essential in every aspect of life, at every level, and for every occupational group. It is as necessary for a painter or a poet as it is for a worker in the industry."* However, some teachers believe that choosing professions without mathematics requirements may mitigate the negative impact of MLD. Therefore, leading students towards different fields could prevent the problem. T2 stated, *"Students who dislike mathematics can compensate for their lack of proficiency by pursuing other fields where they can demonstrate their abilities."* T4 asserted, *"I do not believe that mathematics is necessary for the profession, and therefore, it will not have a negative impact."*

Theme 2: Teachers' Classroom Practices

This section of the paper deals with a thorough explanation of the following sub-themes: Practices before the instruction, practices during the instruction, classroom layout, evaluation of student achievement, and difficulties in implementation under the theme of teachers' classroom practices.

Practices before the Instruction

All the teachers reported that they planned and prepared the lesson before teaching, and they expressed their opinions on planning based on the level of the students, teaching methods, and materials. Teachers followed the curriculum and tailored their lesson plans to students' performance. This situation suggests an overall plan for the whole class without a different plan for students with MLD. Only three teachers indicated that they considered learning outcomes in their preparation. Still, they did not clearly explain whether these learning outcomes were for the whole class or the students with MLD. T1 said, *''We attach importance to photocopy-supported activities in a simple style, following the curriculum and based on our special research.''* T18 expressed, *''Some students struggle to sort out the calculations and solve the problems owing to a lack of understanding. We sometimes provide simpler questions for these students.''*

Two of the teachers stated that they did not make any preparations. This was because the classes were too crowded, and dealing with the students individually was impossible. T4 expressed, *''I cannot make plans due to the overcrowded class. It is not feasible to provide personalized attention to students.''* Likewise, T6 added, *''We cannot plan much.''*

Most of the teachers asserted that they prepare their materials before teaching. These are visual materials, presentations, the smartboard, and concrete materials. It is worth mentioning that the teachers considered the materials suitable for the whole class and did not prepare alternative materials. For example, T3 said, *"We support the class with visual materials."* T1 also said, *"We especially get assistance from the smartboard."*

One of the prominent findings might be that one of the teachers decides the method to be used before instruction. However, as with the other teachers' opinions, this teacher's view also addresses the whole class as the target group. To illustrate, T17 expressed: *''I investigate and implement teaching methods. I determine the needs of the students and plan the lesson accordingly.''* The findings revealed that teachers did not have sufficient knowledge about lesson plans, materials, and the selection of proper methods-techniques before teaching.

Practices during the Instruction

Teachers shared their opinions about the choice of methods and techniques and the use of materials in the teaching process. Accordingly, lectures, learning by doing, drama, demonstration, play, peer teaching, one-on-one teaching, and question-answer are the methods and techniques that teachers frequently employ. This shows that teachers did not include variety in selecting methods and techniques to support students with MLD. Considering that students with MLD do not learn with the same methods as their peers who show typical development, it is noteworthy that teachers choose methods that are more suitable for the general classroom. Also, teachers mostly gave answers about teaching principles, such as progressing from simple to complex, known to unknown, and concrete to abstract, indicating that the content is gradually presented during instruction. T3 stated, *''I explain the subject from simple to complex, concrete to abstract. I use the learning-by-doing method.'' T6 said, ''From simple to difficult, I use one-on-one teaching method.''* One of the teachers claimed that diversity may not be incorporated in selecting method techniques to support students with MLD. T4 explained, *''Technically, I involve these students in the techniques I apply in class. So, they are not isolated from the class.''*

Most teachers utilize the materials available in the classroom during the teaching process. They prefer concrete materials to enhance understanding and encourage student interaction. For instance, T7 stated, *"I use math boxes for addition, toy houses for ones and tens, walnuts, pencils, and fraction sets for division. In problem-solving, it is beneficial to explain by using the shapes."* T19 added that *"I use many materials in the lesson. I bring the student together with the materials.''*

The findings also stress that some teachers selected materials based on the student's level. T11 expressed, *"I first prepare an IEP for my student in cooperation with the counselor. I assess their mathematical performance and teach basic math using the materials available depending on the data."* T5 stated, *"I prepare materials appropriate for the student's level."* The statement underlines that only one of the teachers prepares materials.

A teacher mentioned that visualization in teaching is essential and can be achieved using materials such as concept maps, graphs, and figures to facilitate student understanding. T15 explained, *"Using concept maps, graphs, and figures can facilitate the participation of students with special needs in the learning process."* A teacher also stressed technology-supported teaching, stating, *"I utilize presentations, slides, and videos."*

Classroom Layout

Most teachers reported making physical classroom arrangements, such as colorful boards, information signs, and posters, to summarize or make the subject more concrete. For instance, T14 stated, *"I hang big pictures summarizing the subject on the board."* Similarly, T2 said, *"I utilize boards, posters, and colorful signs to convey information."*

However, teachers use visual materials and decorate the classroom with mathematics activities related to the subject to appeal to multiple senses. For instance, they use colors and shapes to draw students' attention to the subject. T20 stated, *"I decorate the classroom with mathematics activities that appeal to more sensory organs. Visual aids are an effective tool for concretizing abstract mathematical concepts. Such aids are beneficial for students who struggle with addition."* T7 expressed, *"I present activities related to numbers, fractions, rhythmic counting, or geometric shapes on the classroom walls."* Cubes, colored papers, orange slicing, graphs, shapes, concept maps, and number tables are also mentioned by the teachers. T15 added, *"I primarily use visual concept maps, graphics, and shapes in activities."* T10 said, *"I use cubes for addition and real-life examples, such as slicing an orange in the classroom, to teach fractions*."

Despite being the least frequent in teachers' evaluations, the most notable activities were reading books and creating a classroom corner. T17 emphasized the role of reading books in concretizing the subject, stating, *"I read books with mathematical context; I tell stories. Thus, I concretize the subjects."* T9 discovered that learning corners facilitated the learning process and increased student engagement. T9 stated, *''I prepare rhythmic counting corners to increase the comprehensibility of the subject.''*

Another less-frequently mentioned aspect is the seating position of the students in the classroom. Arrangements for students to sit in the front rows are necessary to ensure careful listening and reduce sight-hearing problems. T19 said, *"I seat students with LD in the front rows so that they can see the board better and listen more carefully."* T8 expressed, *"As classroom layout can effectively address sight and hearing problems, I provide solutions for these issues."*

The findings indicate that four teachers did not make physical arrangements in the classroom. The reasons were crowded classrooms, yearly changes, and excessive costs. For example, T5, *"There are limited opportunities for such arrangements due to the necessary costs and the need for permission from the school administration. It can be challenging to arrange as the classes*

change every year." T6 said, *"I cannot say that I made arrangements since the classrooms are overcrowded.''* In general, the physical arrangements made by teachers to support students with MLD appear quite limited.

Evaluation of Student Achievement

Teachers consider the student's level when assessing their achievements. They use level-appropriate questions, worksheets, alternative question types, short answer questions with simple operations, quizzes, and tests to evaluate success. For instance, T8 stated, *"In my evaluation, I assess if students can solve questions of their levels as well as they solve questions on the board."* T13 also explained, *"My assessment criteria are based on student's abilities, measuring at their level. I design exams or tests appropriate to their level.''*

Teachers use observation as another method to evaluate student achievement. Observation is used to assess the student's performance in the classroom and track their progress. According to T16, *"In our class, evaluations are based on observation. I follow the development in the process.''* T4, *''I observe their performance in the classroom.''*

One remarkable finding regarding teachers' evaluation is that only two teachers reported considering IEP outcomes. These teachers stated that they do not evaluate students on class outcomes but on whether they have achieved the set goal. T11 explained, *"I evaluate the achievements of these students on the IEP objectives I have prepared rather than comparing them to the whole class or MoNE objectives."* T17 expressed, *"I assess whether the student has met the target set for them, such as successfully performing addition with numbers from one to twenty."*

When assessing the performance of students with MLD, some teachers made no adjustments. Methods used to assess the whole class include written tests, activity sheets, class participation, scales, and oral questioning and answering. T5 stated, *"I evaluate the situation in the class and the written exams."* Besides, T14 said, *"I assess the written or oral question and answer and participation in-class activities."* The findings indicate that teachers have limitations in assessing students' achievement with MLD, as evidenced by their practice.

Difficulties in Implementation

All teachers encountered difficulties when teaching mathematics to students with MLD. Student-related concerns construed these difficulties. For example, the factors hindering teachers from performing effective instruction include students below grade level, distraction, forgetfulness, indifference to the lesson and homework, prejudice, negative attitudes, learned helplessness, and lack of self-confidence. Teaching students below the grade level was considered the biggest challenge of the abovementioned factors. Accordingly, T5 stated, *"Teachers have difficulty completing coursework and giving adequate attention to students who need extra hours of instruction. Falling behind causes greater problems as the gap expands over time."* T3 also added, *"As mathematics is an abstract field, students often encounter difficulties in learning. This can hinder their ability to progress to new topics."*

Another finding reveals that teachers are challenged by the lack of classroom materials. This issue is consistent with the sub-theme of teaching processes. The unavailability of materials may negatively impact the teaching process. T1 stated, *"Sometimes we may have problems in terms of materials. Mathematics classes should be offered in every school, and special conditions and opportunities should be provided to develop this skill."* T11 expressed, *"We have difficulty accessing sufficient visuals or materials for each subject."* This suggests that teachers use pre-made materials rather than creating materials tailored to the needs of students with MLD.

Furthermore, teachers emphasize the teacher-related reasons for the difficulties in practice. Teachers considered their knowledge and skills about MLD inadequate. For example, T10 said, *"We have difficulties because of inadequate knowledge and skills about this subject. Moreover, teachers found it problematic to prepare questions and activities, assignments, and assessments for students with MLD."* T16 stated, *"Preparing activities and questions for them is difficult and demanding.''* T2 explained, *''It is hard to teach, evaluate, and assign homework at their level.''* One of the teachers emphasized the limitations of teaching techniques. T17, *''The lack of appropriate teaching techniques for these students often makes it difficult for us to plan and manage the process.''*

Another issue that teachers encountered was related to the learning environment. Reasons cited for difficulties included missed deadlines, classroom management, and overcrowded classrooms. Teachers linked the problems with the low level of the students most. Correspondingly, T4 stated, *"The fact that they are below the class level causes difficulties in classroom management. In addition, the overcrowded classes make it difficult for us to communicate with each student and prevent communication with students with MLD. Consequently, less communication means less success." T6 mentioned ''There needs to be repetition and question-solving. We have time problems in covering the subjects.''* In addition, the teachers also highlighted the reasons stemming from the families. The family's lack of interest and refusal to accept support negatively affected the practices. For example, T18 said, *"Sometimes the student does not make the necessary effort to learn and does not stay for one-on-one instruction. Sometimes, the family does not allow it. They should get assistance from an expert, but they do not accept it.''* T7 said, *"If the family lacks patience and help for the child, the teacher cannot assist at school."*

DISCUSSION, CONCLUSION AND SUGGESTIONS

Two main themes were identified to determine teachers' knowledge about MLD and their classroom practices: teachers' knowledge and teachers' classroom practices.

Teachers' Knowledge

Teachers' knowledge was analyzed under the sub-themes of the definition of MLD, causes of MLD, and effects of MLD on students. It was found that teachers associated the concept of MLD with deficiencies in mathematical skills, numbers, problem-solving, four operations, calculations, and difficulty in learning mathematical concepts. Only four teachers emphasized "the absence of mental deficiency" in the definition. Thus, teachers can be considered to have conceptual knowledge limitations. An analysis of teachers' definitions of MLD revealed that they mainly mentioned the commonly failed skills and the symptoms of MLD instead of using distinctive and specific expressions. In the literature, some studies unearthed that teachers define MLD in an equivalent way (Avcı, 2020; Hacısalihoğlu Karadeniz, 2013; Sezer & Akın, 2011).

In the DSM-V, learning disability is defined as having average or above-normal intelligence and not caused by any disability or environmental conditions. IDEA (2004) emphasizes that learning disabilities do not include learning problems caused by intellectual disability, emotional disturbance, or environmental, cultural, or economic disadvantage. Thus, MLD refers to underachievement despite normal and abnormal intelligence, emotional stability, educational opportunities, and motivation. The study revealed that teachers explained the causes of MLD in terms of factors such as intelligence, intellectual disability, genetics, environment, curriculum intensity, exposure to technology, lack of instruction, lack of attention, and nutrition. Their knowledge of the subject was relatively superficial and inadequate. The teachers' statements displayed that they attributed MLD to other disability groups and numerous factors that could cause low achievement. Teachers' lack of knowledge about the causes of MLD is often emphasized (Kaçar, 2018). Teachers' misconceptions about learning disabilities and difficulties may also initiate this situation.

Another point is that teachers have limited knowledge about how MLD impacts students' educational, daily, and professional lives. It was highlighted that MLD leads to low academic performance and deteriorating relationships with teachers, family, and peers. The teachers' statements about the impact of academic failure on students' psychology (e.g., loss of self-confidence, isolation, pressure) demonstrated that they were conscious of the problem. However, teachers' statements about the impact of MLD on everyday life were quite limited. Mathematics is needed in many areas, such as calculating distances and costs, scheming dates and calendars, and using numerical expressions in our daily needs. It was ascertained that the teachers could superficially explain the prominence of mathematics, stating that it is only necessary to tell the time, shop, and calculate changes. The greatest confusion among teachers is related to the impact of MLD on professional life. The significance of math skills in students' lives is evident due to their impact on school attendance and their requirements in various occupational groups. For example, Heine et al. (2013) identified a link between poor mathematical skills and psychosocial and economic risks, indicating that those affected might drop out of school, and only a minority are employed full-time at age 30. In this research context, it can be argued that teachers are not fully aware of MLD's impact on career choices.

Teachers' Classroom Practices

Teachers' classroom practices were examined under the sub-themes of practices before teaching, practices during the teaching process, classroom layout, evaluation of student achievement, and difficulties in implementation.

Consequently, it was found that the teachers do not make in-class applications for students with MLD. This suggests that the teachers created a plan without considering the performance of the students with MLD in the classroom practice. Remarkably, some teachers did not make any adjustments to their lesson planning. The teachers' preparation of materials and teaching methods also displayed an analogous situation. It was noted that teachers planned their lessons through visuals, smart boards, and concrete materials in the classroom environment. However, none of the teachers prepared materials to address the needs and content of students with MLD. The choice and use of a single teaching method for the whole class suggests that the teachers' preparation process before teaching is inadequate. In a study conducted by Özkubat et al. (2021) with teachers working with students with learning difficulties, it was revealed that teachers planned the lesson in the same way for students with and without learning difficulties. One of the important results that emerged within the scope of the research is that the methods used by teachers may have applications that they use not only for students with MLD, but also for all students. Such applications also contribute to students with MLD in the classroom environment. It can be thought that teachers who adopt the Universal Learning Design in their classroom applications by taking into account students with different abilities or different learning characteristics. However, when the results obtained from the research are examined from a detailed framework, it is seen that teachers do not make any special applications for students with MLD.

The research yielded how teachers conducted the teaching process, including lectures, learning by doing, drama, demonstration, play, peer teaching, one-on-one teaching, and question-answer method. As found in similar studies, teachers frequently use these methods (e.g., Kaçar, 2018; Özkubat et al., 2021; Temur et al., 2018). It is noted that the methods and techniques teachers use are quite limited and inappropriate. This result is like those in the literature (Avcı, 2020; Kaçar, 2018). Research conducted on students with MLD shows that these students cannot learn with the same methods and at the same speed as their peers with normal development (Re et al., 2014). It is inevitable that the instructional strategies used to support the individual mathematics learning of students with learning difficulties will vary (Akçin, 2019). For example, it is recommended to

focus on instructional strategies such as explicit teaching, strategy teaching, direct teaching, metacognitive approach and supportive teaching (Berkeley et al., 2010, as well as practices such as direct teaching, modeling, providing guided application opportunities, adjusting progress, error correction and recording progress (Akçin, 2019). The study also revealed that the question-answer method was the most preferred by the teachers. The use of simple questions adapted to the level of the students indicated that some teachers made adaptations, yet only partially. However, the learning characteristics of students with MLD are often neglected as most teachers teach to the whole class. These findings are supported by other studies in the literature (Acar & Hiğde, 2018). The second issue addressed in the teaching process concerns the teaching materials. According to the study, teachers reported using pre-made materials that offer visual aids and address multiple senses. However, the study also revealed that teachers lack planning and adapting materials. Some teachers did mention adapting the materials according to the performance and level of the students.

In terms of classroom layout, teachers are found to decorate the classroom with mathematical activities appropriate to the subject and use colorful bulletin boards, and posters. They also stated that these arrangements were necessary for engaging multiple senses and aiding visualization. Book reading and rhythmic counting corners were less favored in the classrooms. Only two teachers arranged for students to sit in the front rows. Previous studies have mentioned that students were seated close to the teacher, and physical adaptations were made in the classroom (e.g., Koç, 2018; Özkubat et al., 2021). A significant finding of this study is that some teachers did not adjust the physical arrangement of the classroom. The teachers listed several reasons for not adjusting, including the need to save money, changing the classroom every year, and overcrowded classrooms.

The research also found limitations in teachers' ability to assess student achievement. The preferred assessment methods include level-appropriate questioning, worksheets, alternate questioning, short answer questions with simple operations, quizzes, and tests. Only two teachers stated that they consider the results of the IEP and do not evaluate students solely on class results but also on whether the student has reached the set objective. Teachers use various methods to evaluate student success, including whole-class written exams, activity sheets, class participation, scales, and oral question and answer. However, these methods lack regulation and consistency in assessing student achievement. The results of the study revealed shortcomings and limitations in teachers' classroom practices for students with MLD, consistent with previous studies (Acar & Hiğde, 2018; Avcı, 2020; Sezer & Akın, 2011).

The research found that teachers experienced problems in their practice due to student-related reasons, teachers, learning environment, material insufficiency, and families. It is noteworthy that teachers emphasize student issues, following previous studies (Hacısalihoğlu Karadeniz, 2013; Sezer & Akın, 2011). Teachers' preference for materials can be inferred from their reports of difficulties due to lack of materials. These difficulties include keeping up with the pace, managing the classroom, and dealing with overcrowded classes caused by students falling back and needing too much repetition. Additionally, the research indicates that the absence of family support and indifference toward the student is a result that aligns with the literature (e.g., Avcı, 2020).

As a result of the study, it was determined that teachers had insufficient knowledge about MLD and their classroom practices were also inadequate. Therefore, seminars and trainings can be organized to increase teachers' knowledge about MLD. In addition, in order to overcome teachers' limitations in classroom practices, in-service courses on methods and techniques that can be used in mathematics lessons and on developing materials that appeal to multiple senses can be planned by the Ministry of National Education. By planning these courses regularly, teachers' theoretical and practical knowledge can be increased. It is also important to encourage teachers to attend seminars and in-service trainings on MLD. Guidance booklets can be prepared for teachers to be informed about MLD and the methods, techniques, strategies and materials they can use in the classroom.

The research focused on the determination of teachers' knowledge about MLD and their views on classroom practices. It may be recommended that future research should be more comprehensive and use different data collection tools that provide detailed and rich information on the subject. In addition, research can be conducted to examine the knowledge and classroom practices of subject teachers at the middle and high school levels.

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We hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Researchers' contribution rate

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